

US005986330A

United States Patent [19]

Kalnitsky et al.

[11] Patent Number:

5,986,330

[45] Date of Patent:

Nov. 16, 1999

[54] ENHANCED PLANARIZATION TECHNIQUE FOR AN INTEGRATED CIRCUIT

[75] Inventors: Alex Kalnitsky, Grenoble, France; Yih-Shung Lin, Plano, Tex.

[73] Assignee: STMicroelectronics, Inc., Carrollton,

Tex.

[21] Appl. No.: 09/007,668

[22] Filed: Jan. 15, 1998

Related U.S. Application Data

[63] Continuation of application No. 08/456,343, Jun. 1, 1995, abandoned, which is a continuation of application No. 08/163,043, Dec. 6, 1993, Pat. No. 5,435,888.

[51]	Int. Cl.	· . 	H01L 23/58
	TT 0 01		

257/6:

[56] References Cited

U.S. PATENT DOCUMENTS

4,253,907	3/1981	Parry et al	156/643
4,354,896	10/1982	Hunter	156/643
4,384,938	5/1983	Desilets et al	204/298
4,654,112	3/1987	Douglas et al	156/643
4,657,628	4/1987	Holloway et al	156/643
		· · · · · · · · · · · · · · · · · · ·	

(List continued on next page.)

FOREIGN PATENT DOCUMENTS

2083948A	3/1982	European Pat. Off
0111706	6/1984	European Pat. Off
0265638	5/1988	European Pat. Off
327 412	8/1989	European Pat. Off
0185787	1/1992	European Pat. Off
0491408	6/1992	European Pat. Off
410244	1/1991	Germany.
60-58635	4/1985	Japan .
61-26240	2/1986	Japan .
61-232646	10/1986	Japan .
62-106645	4/1987	Japan

63-293946 11/1988 Japan . 4092453 3/1992 Japan .

2167901A 4/1986 United Kingdom.

8901236 5/1992 United Kingdom.

OTHER PUBLICATIONS

IBM Technical Disclosure Bulletin, vol. 30, No. 8, p. 252, Jan. 1988.

IBM Technical Disclosure Bulletin, vol. 29, No. 3, p. 1328, Aug. 1986.

"A New Technology for Oxide Contact and Via Etch", by Pete Singer, Semiconductor International, p. 36 (1993). Handbook on Semiconductors, (ed. C. Holson), vol. 4, p. 208 (1981).

"Etching Applications and Trends of Dry Etching", Ephrath et al., Semiconductor Technology and Computer Systems, Ch. 2, p. 26. 1991.

VLSI Électronics Microstructures Science, vol. 8, ed. Norman Einspruch, p. 298 (1984).

"Plasma Etch Anisotrophy", C.B. Zarowin, J. Electrochem. Soc., Solid-State Science and Technology, p. 1144 (1983). "A Super Self-Aligned Source/Drain MOSFET," Lau et al., IEDM, p. 358 (1987).

"A Margin-Free Contact Process Using an AI303 Etch-Stop Layer for High Density Devices", Fukase et al., IEDM, p. 837 (1992).

Research Disclosure No. 282, Oct. 1987, Havant GB p. 608, "Spin on Glass Insulator Enhancement".

"Etching—Applications and Trends of Dry Etching", by L.M. Ephrath and G.S. Mathad, Handbook of Advanced Technology and Computer Systems at 27 ff (1988).

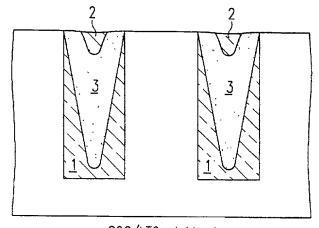
(List continued on next page.)

Primary Examiner—Stephen D. Meier Attorney, Agent, or Firm—Theodore E. Galanthay; Lisa K. Jorgenson

[57] ABSTRACT

A method for planarizing integrated circuit topographies, wherein, after a first layer of spin-on glass is deposited, a layer of low-temperature oxide is deposited before a second layer of spin-on glass.

22 Claims, 4 Drawing Sheets



SOG/LTO etchback

U.S. PATENT DOCUMENTS

4,660,278	4/1987	Teng 29/576
4,676,867	6/1987	Elkins et al
4,707,218	11/1987	Giammarco et al 156/643
4,721,548	1/1988	Morimoto .
4,755,476	7/1988	Bohm et al 437/31
4,792,534	12/1988	Tsuji et al 437/229
4,801,350	1/1989	Mattox et al 156/643
4,801,560	1/1989	Wood et al 437/195
4,824,767	4/1989	Chambers et al 430/313
4,894,351	1/1990	Batty 437/190
4,912,061	3/1990	Nasr et al 437/44
4,962,414	10/1990	Liou et al 357/71
4,986,878	1/1991	Malazgirt et al 156/643
5,003,062	3/1991	Yen 437/231
5,063,176	11/1991	Lee et al 437/195
5,068,711	11/1991	Mise 257/752
5,110,763	5/1992	Matsumoto .
5,117,273	5/1992	Stark et al 357/54
5,158,910	10/1992	Cooper et al 437/195
5,166,088	11/1992	Ueda et al 437/47
5,244,841	9/1993	Marks et al 437/228
5,250,472	10/1993	Chen et al
5,266,525	11/1993	Morozumi 437/195
5,310,720	5/1994	Shin et al 437/231
5,320,983	6/1994	Ouellet et al
5,435,888	7/1995	Kalnitsky et al
5,534,731	7/1996	Cheung 257/752

OTHER PUBLICATIONS

"Reactive Ion Etching", by B. Gorowitz and R. Saia, 8 VLSI Electronics, 297ff (1984).

Patent Abstracts of Japan, vol. 15, No. 348 (E-1107) Sep. 4, 1991 & JP-A-31 33 131 (Mitsubishi Electric Corp.) Jun. 6, 1991.

"Three 'Low Dt' Options for Planarizing the Premetal Dielectric on an Advanced Double Poly BiCMOS Process", by W. Dauksher, M. Miller, and C. Tracey, J. Electrochem. Soc., vol. 139, No. 2, p. 532 (1992).

"The Effect of Plasma Cure Temperature on Spin-On Glass", by H. Namatsu and K. Minegishi, J. Electrochem. Soc., vol. 140, No. 4, p. 140 (1991).

"Hot-Carrier Aging of the MOS Transistor in the Presence of Spin-On Glass as the Interlevel Dielectric", by N. Lifschitz and G. Smolinsky, IEEE Electron Device Letters, vol. 12, No. 3, p. 140 (1991).

"Advantages of Using Spin on Glass Layer in Interconnection Dielectric Planarization", Microelectronic Engineering, vol. 5 (1986).

"Doped Silicon Oxide Deposition by Atmospheric Pressure and Low Temperature Chemical Vapor Deposition Using Tetraethoxysilane and Ozone", Fujino et al., J. Electrochem. Society, vol. 138, No. 10, p. 3019 Oct. 1991.

"Polysilicon Planarization Using Spin-On Glass", S. Ramaswami and A. Nagy, J. Electrochem. Soc., vol. 139, No. 2, p. 591 (1992).